



## Transoral ultrasound: a helpful and easy diagnostic method in obstructive salivary gland diseases

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### Key Points

- *Transoral ultrasound is a simple technique, very helpful for the evaluation of obstructive diseases of the salivary glands.*
- *It overcomes most of the limitations of transcutaneous ultrasound.*

The two most frequent salivary gland disorders are tumors and obstructive sialadenopathies, with 90% of the latter being caused by sialolithiasis and ductal stenoses [1]. Ultrasound establishes the diagnosis in case of obstructive diseases with a sensitivity and specificity of more than 95% [2, 3]. However, there are some limitations: for the parotid gland, the distal part of the duct and papilla region often cannot be clearly depicted due to artifacts; for the submandibular gland, evaluation is limited by the dorsal sound extinction caused by the mandible in the distal parts of the duct, or by the large distance between the transducer and the hilum area of the gland. Unfortunately, most obstructive causes are situated exactly in these locations [4].

Sialendoscopy is the reference standard to determine the cause of the obstruction, be it a concrement or a stenosis, by direct visualization [4–6]. However, sialendoscopy is not available everywhere.

We would therefore like to report about transoral ultrasound as a promising, real-time, and easy-to-use technique to determine obstructive causes without the limitations of the transcutaneous approach.

We use a high-end ultrasound system (Acuson S3000, Siemens Healthineers), equipped with a hockey-stick transducer (14 L5 SP, frequency range 5–14 MHz, Siemens Healthineers) which is covered with a disposable polyurethane sleeve filled with ultrasound jelly (Fig. 1a). The best results of this study were obtained when the probe was operated with

10–14 MHz. The transducer can be placed onto the oral mucosa of the cheek to examine the distal parotid duct including the papilla region, or onto the mucosa of the floor of the mouth to directly depict the complete submandibular duct, including the submandibular gland's parenchyma and papilla. Manual pressure from the outside (“sonopalpation” [7, 8]) and administration of ascorbic acid powder which stimulates salivation [9] can both be used to enhance findings.

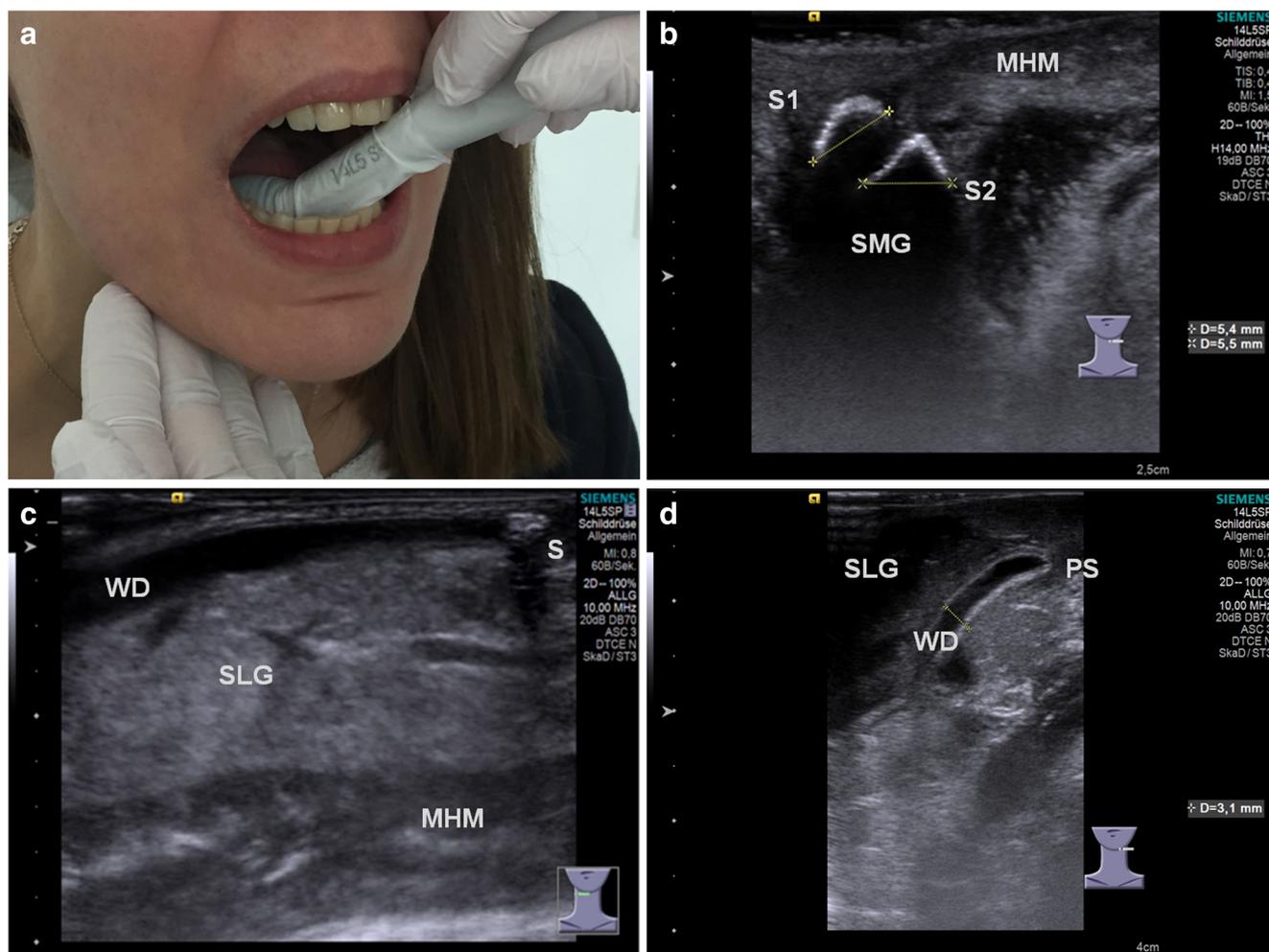
In this way, it is possible to minimize the distance from the transducer to the region of interest, the interfering sound extinction of the mandible when examining the distal submandibular duct as well as the disturbing influence of artifacts (e.g., air bubbles at the oral mucosa). A high number of distal sialoliths and duct stenoses of the parotid gland [4] and virtually all locations causing obstruction in the submandibular gland (Fig. 1b–d) can be depicted with this method; it is possible to find stones of even less than 1 mm. Furthermore, other pathologies causing obstructions, such as space-occupying lesions or ranulas (salivary pseudocysts in the floor of the mouth adjacent to damaged salivary glands) which compress the duct from the outside, can be identified. The high spatial resolution of the transoral ultrasound approach allows a precise differential diagnosis, enabling reasonable treatment often without the need for additional imaging.

Transoral ultrasound imaging can be limited, as the shape of the transducer exhibits reduced maneuverability in the oral cavity. For this reason, the alignment cannot be reversed and the orientation of the images is the same for the left and right sides. Secondly, transoral imaging is not applicable in smaller children due to noncompliance. Thirdly, the proximal part of Stensen's duct and the parotid gland parenchyma are not accessible due to the ascending part of the mandible.

Apart from these limitations, this technique provides outstanding imaging quality in selected indications, comprises a

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**Fig. 1** Performing transoral ultrasound in obstructive sialadenopathies. **a** (top left) The ultrasound transducer during intraoral application, assisted by “sonopalpation.” **b** (top right) Stones (S1, S2) in the hilum area of the left submandibular gland (SMG); two concretions can be clearly distinguished from one another. **c** (bottom left) Transoral image of a small stone

(S, 1.5 mm) next to the papilla in the right Wharton’s duct (WD). **d** (bottom right) The most important differential diagnosis of sialolithiasis is duct stenosis, shown here as a papilla stenosis (PS) of the left Wharton’s duct (WD). MHM, mylohyoid muscle; PS, papilla stenosis; S, stone(s); SLG, sublingual gland; SMG, submandibular gland; WD, Wharton’s duct

real-time imaging method that can be used during the diagnostic and therapeutic process, and serves as a reliable technique to identify the obstructive cause in places where sialendoscopy is not available.

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### Compliance with ethical standards

**Guarantor** The scientific guarantor of this publication is Mirco Schapher, M.D., MSc.

**Conflict of interest** The authors of this manuscript declare no relationships with any companies, whose products or services may be related to the subject matter of the article.

**Statistics and biometry** No complex statistical methods were necessary for this paper.

**Informed consent** Written informed consent was obtained from all subjects (patients) in this study for the diagnostic routines and therapy, including the performed examinations and procedures.

**Ethical approval** Institutional Review Board approval was not required because standard diagnostic routines and therapies were performed, and for all patients included, an informed consent was obtained.

### Methodology

- prospective
- diagnostic or prognostic study
- performed at one institution

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